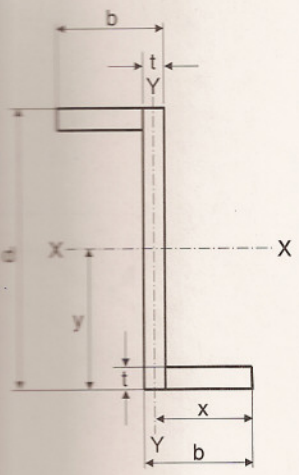
# PROPERTIES OF GEOMETRIC SECTIONS AND STRUCTURAL SHAPES




$$A = t[d + 2(b - t)]$$

$$y = \frac{d}{2}$$

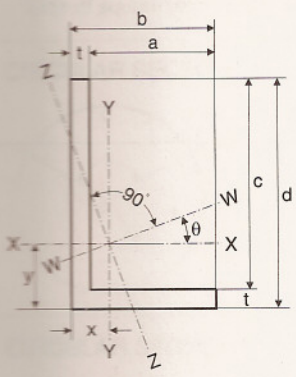
$$I = \frac{bd^3 - (b - t)(d - 2t)^3}{12}$$

$$S = \frac{I}{y}$$

$$r = \sqrt{\frac{bd^3 - (b - t)(d - 2t)^3}{12t[d + 2(b - t)]}}$$

## ANGLE

Axis of moments through Centre of gravity




Z-Z is axis of minimum I

$$\tan 2\theta = \frac{2K}{I_y - I_x}$$

$$A = t(b + c) \qquad x = \frac{b^2 + ct}{2(b + c)} \qquad y = \frac{d^2 + at}{2(b + c)}$$

K = Product of Inertia about X-X & Y-Y

$$= \mp \frac{abcdt}{4(b + c)}$$

$$I_x = \frac{1}{3}\left(t(d - y)^3 + by^3 - a(y - t)^3\right)$$

$$I_y = \frac{1}{3}\left(t(b - x)^3 + dx^3 - c(x - t)^3\right)$$

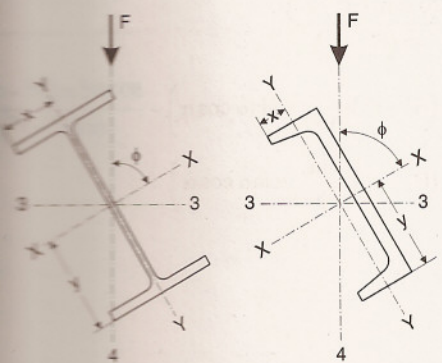
$$I_z = I_x \sin^2\theta + I_y \cos^2\theta + K \sin 2\theta$$

$$I_w = I_x \cos^2\theta + I_y \sin^2\theta - K \sin 2\theta$$

K is negative when heel of angle, with respect to c.g., is in 1st or 3rd quadrant, positive when in 2nd or 4th quadrant.

## BEAMS AND CHANNELS

Transverse force oblique through centre of gravity




$$I_3 = I_x \sin^2\phi + I_y \cos^2\phi$$

$$I_4 = I_x \cos^2\phi + I_y \sin^2\phi$$

$$f = M\left(\frac{y}{I_x}\sin\phi + \frac{x}{I_y}\cos\phi\right)$$

where M is bending moment due to force F.